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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/820,185	04/07/2004	James Kolodzey	UOD-124US / UD04-46	7420
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RATNERPRESTIA P.O. BOX 1596 WILMINGTON, DE 19899			EXAMINER VAN ROY, TOD THOMAS	
			ART UNIT 2828	PAPER NUMBER
			MAIL DATE 09/10/2007	DELIVERY MODE PAPER

**Please find below and/or attached an Office communication concerning this application or proceeding.**

The time period for reply, if any, is set in the attached communication.

# Office Action Summary

Application No.

10/820,185

Applicant(s)

KOLODZEY ET AL.

Examiner

Tod T. Van Roy

Art Unit

2828

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

## Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

## Status

- 1) ☒ Responsive to communication(s) filed on 05 July 2007.
- 2a) ☒ This action is FINAL. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

## Disposition of Claims

- 4) ☒ Claim(s) 1-29 is/are pending in the application.
- 4a) Of the above claim(s) 17-29 is/are withdrawn from consideration.
- 5) ☒ Claim(s) 8 is/are allowed.
- 6) ☒ Claim(s) 1-7 and 9-16,30-33 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

## Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

## Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some \* c) ☐ None of:
- ☐ Certified copies of the priority documents have been received.
  - ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  - ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

## Attachment(s)

- |  |   |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892)  | 4) <input type="checkbox"/> Interview Summary (PTO-413)<br>Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948)                                   | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152)             |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)<br>Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____  |

## **DETAILED ACTION**

### ***Continued Examination Under 37 CFR 1.114***

A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on 07/05/2007 has been entered.

### ***Response to Amendment***

The examiner acknowledges the amending of claims 1-3, 9, and 11-16, and the cancellation of claims 30-33.

### ***Response to Arguments***

Applicant's arguments with respect to claims 1-16 have been considered but are moot in view of the new ground(s) of rejection.

### ***Claim Rejections - 35 USC § 103***

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

The factual inquiries set forth in *Graham v. John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

Claims 1-6, 10-14 and 16 rejected under 35 U.S.C. 103(a) as being unpatentable over Pavlov et al. (applicant submitted prior art; Stimulated Emission from Donor-Transitions in Silicon, Physical Review Letters 84 (2000) by S.Pavlov et al.) in view of Altukhov et al. (applicant submitted prior art; I.V. ALTUKHOV, E.G. CHIRKOVA, V.P. SINIS, M.S. KAGAN, UY. P. GOUSEV, S.G. THOMAS, K.L. WANG, M.A. ODNOLYUDOV I.N. YASSIEVICH; Towards Si<sub>1-x</sub>GEx quantum-well resonant-state terahertz laser; Applied Physics Letters; December 10, 2001; pp 3909-3911; Vol. 79, No. 24; American Institute of Physics) and in view of Gousev et al. (applicant submitted prior art, "Widely tunable continuous-wave THz laser").

With respect to claim 1, Pavlov teaches a THz frequency emitter comprising an unstrained bulk optical gain material formed substantially of at least one group IV element and doped with at least one dopant having an intra-center transition frequency in a range of about 0.3THz to 30THz (pg.5220 col.1 para.2). Pavlov does not teach the use of electrical pumping. Altukhov and Gousev teach a THz emitter with similar optical gain medium, and includes the use of electrical pumping and corresponding electrodes. It would have been obvious to one of ordinary skill in the art at the time of the invention

to combine the THz emitter of Pavlov with the electrically pumped THz emitter of Altukhov and Gousev in order to simplify the stimulus needed to operate the device and allow for control of the device using means similar to that of commercial semiconductor diode lasers.

*The Examiner acknowledges the differences between the radiation mechanisms but believes that the motivation for using electrical contacts still exists and is shown in analogous art.*

With respect to claim 2, Pavlov teaches the THz radiation source optical gain material includes, a crystalline material formed of an alloy of group IV elements (Si-P, and Boron).

With respect to claim 3, Altukhov teaches the optical gain material is of crystalline silicon phosphorous (pg.5220 col.2 para.2).

With respect to claims 4-6, Pavlov teaches the dopant is of a group III element (B) of shallow depth (pg.5221 col.2 para.3).

With respect to claim 7, Pavlov further teaches the use of a first co-dopant of a first carrier type (pg.5220 col.2 para.2, n-P), and a second co-dopant of a second carrier type (pg.5221 col.1 para.3, p-B), and a first co-dopant concentration of the first co-dopant is at least 5 times a second dopant concentration of the second co-dopant ( $P-2 \times 10^{15}$ ,  $B-1 \times 10^{13}$ ).

With respect to claim 10, Altukhov teaches the first and second electrodes to be of gold (pg.3910 col.1 para.1) a commonly used electrode type.

With respect to claims 11-12, Pavlov, Altukhov and Gousev teach the THz emitter and contacts as outlined in the rejection to claim 1, but do not teach using either ohmic or Schottky barriers for the contact types. It would have been obvious to one of ordinary skill in the art at the time of the invention to use ohmic contacts in order to achieve predictable voltage current relationships with the device, or Schottky barriers to improve the switching speed, as both of these junction types are well known and widely used in the laser, and other semiconductor device arts.

With respect to claim 13, Pavlov teaches a first reflective element and a second reflective element substantially parallel to the first reflective element, the first reflective element and the second reflective element being arranged on either side of the optical gain medium to form a Fabry-Perot laser cavity (pg.5222 col.2 para.2, Fabry-Perot cavity formed using the external mirrors), wherein a reflectivity of the first reflective element is less than 100% (inherent that one must be less than 100% for emission to occur), and the THz frequency radiation source emits coherent THz frequency radiation through the first reflective element.

With respect to claim 14, Pavlov does not teach the optical gain material is coupled to a substrate. It would have been obvious to one of ordinary skill in the art at the time of the invention to make use of a substrate as substrates are well known and widely used bases for growth of semiconductor materials in the laser arts.

With respect to claim 16, Altukhov teaches the optical gain material is formed as a doped region within a substantially undoped material formed substantially of at least

one group IV element (the use of the shallow boron dopant and the larger silicon crystal would create this condition).

Claims 1 and 9 are rejected under 35 U.S.C. 103(a) as being unpatentable over Pavlov et al. (Optically pumped THz silicon lasers, pgs.93-96, IEEE 2002) in view of Altukhov and Gousev.

With respect to claim 1, Pavlov teaches a THz frequency emitter comprising an optical gain material formed substantially of at least one group IV element and doped with at least one dopant having an intra-center transition frequency in a range of about 0.3THz to 30THz (pg.94 col.2 para.1). Pavlov does not teach the use of electrical pumping. Altukhov and Gousev teach a THz emitter with similar optical gain medium, and includes the use of electrical pumping and corresponding electrodes. It would have been obvious to one of ordinary skill in the art at the time of the invention to combine the THz emitter of Pavlov with the electrically pumped THz emitter of Altukhov and Gousev in order to simplify the stimulus needed to operate the device and allow for control of the device using means similar to that of commercial semiconductor diode lasers.

With respect to claim 9, Pavlov further teaches the resistivity of the optical gain material is in the range of about 1 to 10 ohm-cm (pg.94 col.2 para.1, B- $1 \times 10^{15}$  doping level, see applicant disclosure [0034] discussing the resistivity as related to B doping level).

Claim 15 is rejected under 35 U.S.C. 103(a) as being unpatentable over Pavlov, Altukhov and Gousev in view of Soref et al. (US 6154475).

With respect to claim 15, Pavlov, Altukhov and Gousev teach the THz frequency emitter as outlined in the rejection to claim 1, but do not teach the use of a distributed feedback element (DFB). Soref teaches a THz emitter wherein it is taught to be usable as a DFB device (col.3 lines 57-60). It would have been obvious to one of ordinary skill in the art at the time of the invention to combine the THz emitter of Pavlov, Altukhov and Gousev with the DFB THz emitter of Soref in order to provide optical feedback in the device allowing for precise modal control.

Claims 30-33 are rejected under 35 U.S.C. 103(a) as being unpatentable over Pavlov, Altukhov and Gousev in view of Rowell et al. (US 5675414).

With respect to claims 30-33, Pavlov, Altukhov and Gousev teach the device outlined in the rejection of claims 1-3 and 9 above, but do not teach the material to be amorphous. Rowell teaches that amorphous silicon is up to 100 times more absorbing than crystalline silicon (col.4 lines 27-48). It would have been obvious to one of ordinary skill in the art to combine the THz device with the amorphous silicon material in order to absorb more pumping light into the system to stimulate the dopants.

***Allowable Subject Matter***

Claim 8 is allowed.

The following is an examiner's statement of reasons for allowance:




Please see the previous office action for the reasons of allowance (paper no. 08302006).

Any comments considered necessary by applicant must be submitted no later than the payment of the issue fee and, to avoid processing delays, should preferably accompany the issue fee. Such submissions should be clearly labeled "Comments on Statement of Reasons for Allowance."

### ***Conclusion***

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Tod T. Van Roy whose telephone number is (571)272-8447. The examiner can normally be reached on M-F.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Minsun Harvey can be reached on (571)272-1835. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

  
**MIN SUN OH HARVEY  
PRIMARY EXAMINER**

Art Unit: 2828

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

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